An Overview of Pipeline Configuration Alternatives

Presentation Objectives

- basic concepts
- simplified definitions
- historical background

Basic Concepts and Definitions

- single wall pipelines
- pipe-in-pipe pipelines
- pipe bundle pipelines
- typical installation equipment
- typical installation methods

Historical Background

- pipe-in-pipe and pipe bundle installation
- statistics on worldwide installation
- installed lengths, sizes, water, depth, etc.

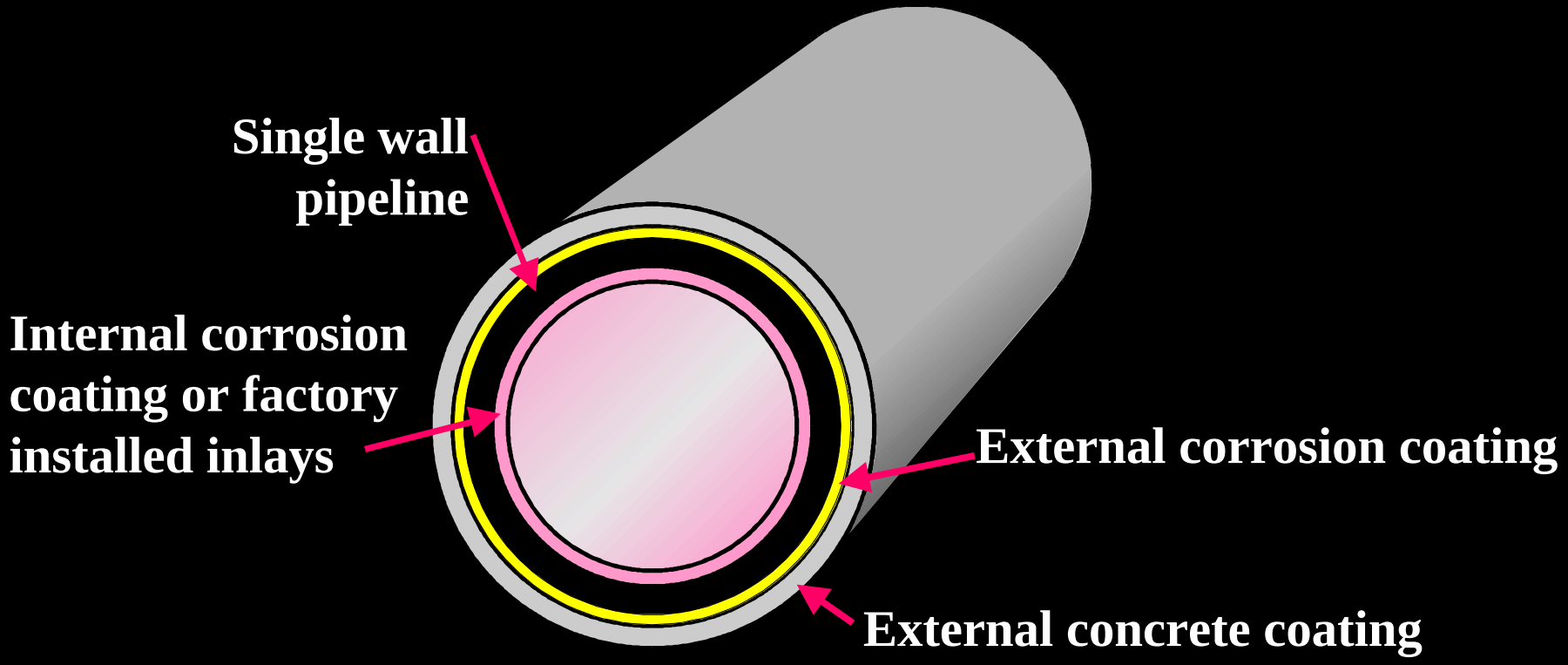
Breakout Sessions

Discussion of:

- comparison of pros and cons of various alternatives
- preferred pipeline configuration for Alaska's offshore

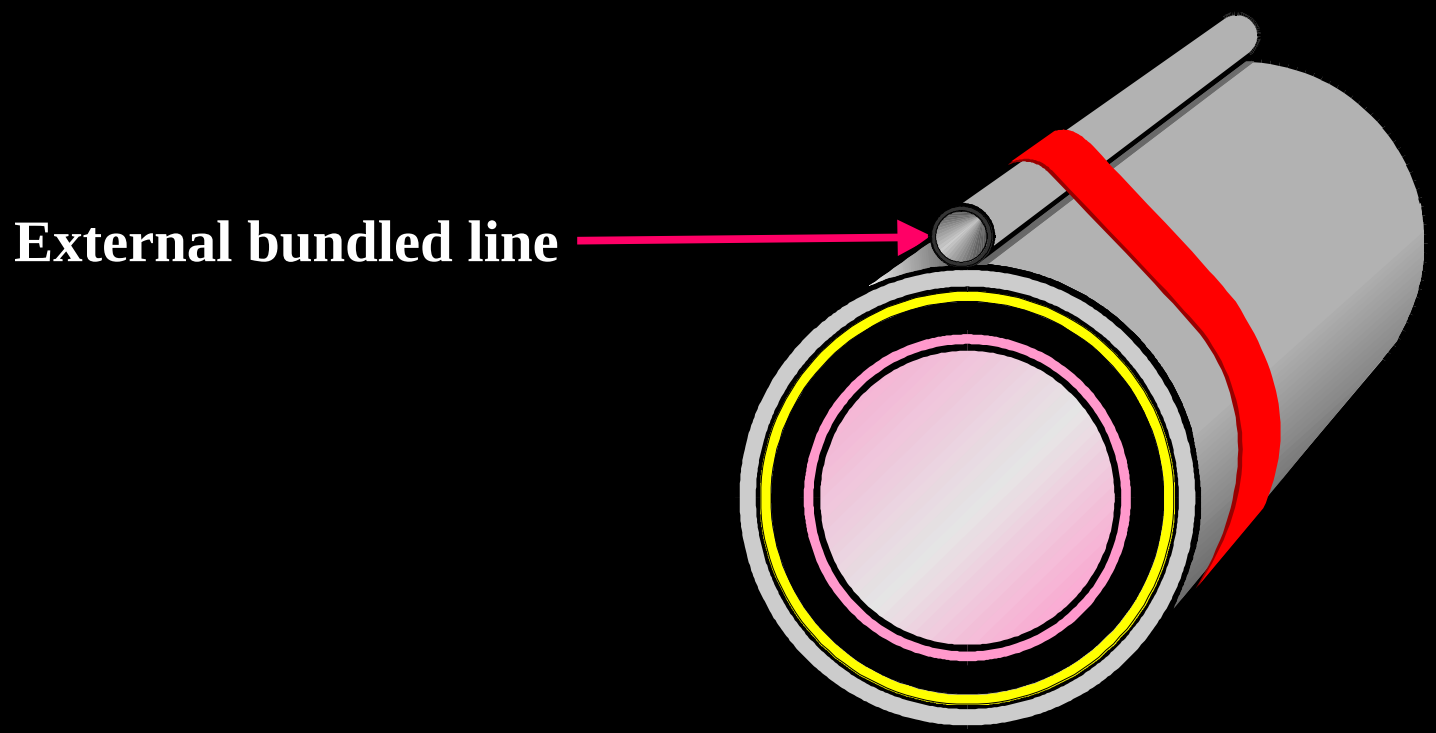
Pipeline Configurations

Single Wall Pipelines



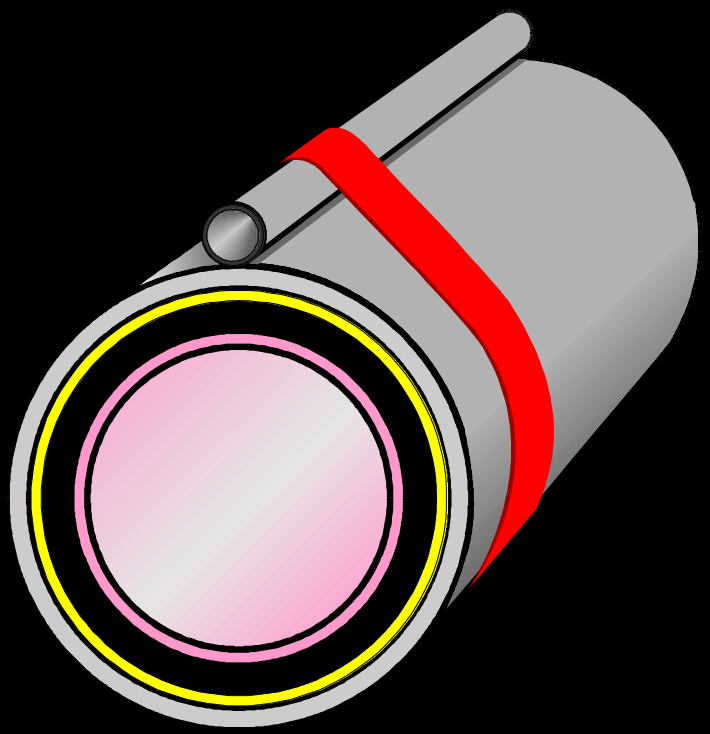
Pipeline Configurations

Single Wall Pipelines - with external bundled line



Pipeline Configurations

Single Wall Pipelines



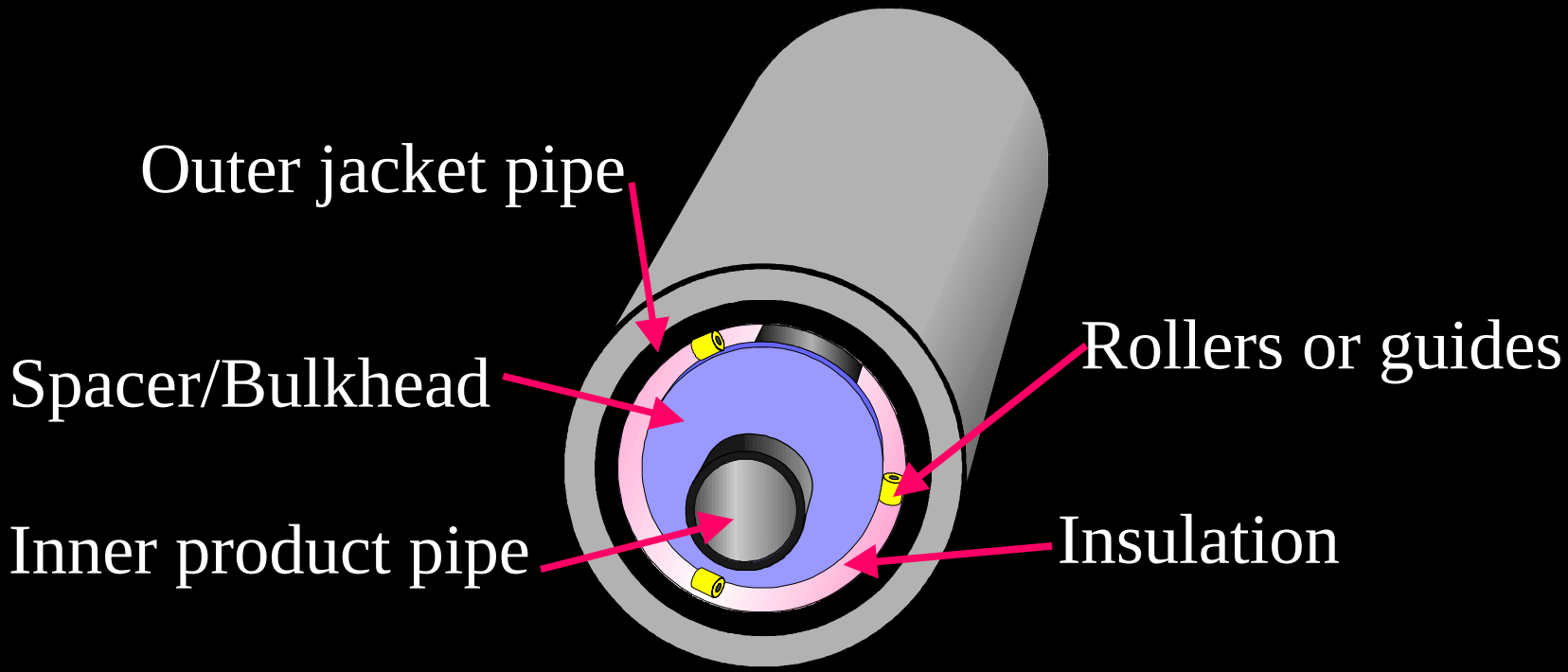
Applications:

- most areas of the world
- wall thickness and coating variations match requirements
- external bundles requiring operating flexibility

Pipeline Configurations

Pipe-in-Pipe Pipelines

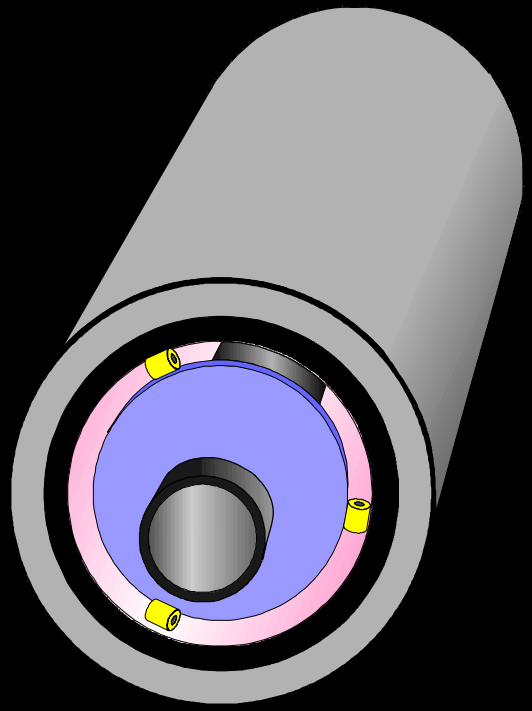
Single Pipe-in-Pipe (Concentric)



Pipeline Configurations

Pipe-in-Pipe Pipelines

Single Pipe-in-Pipe (Concentric)



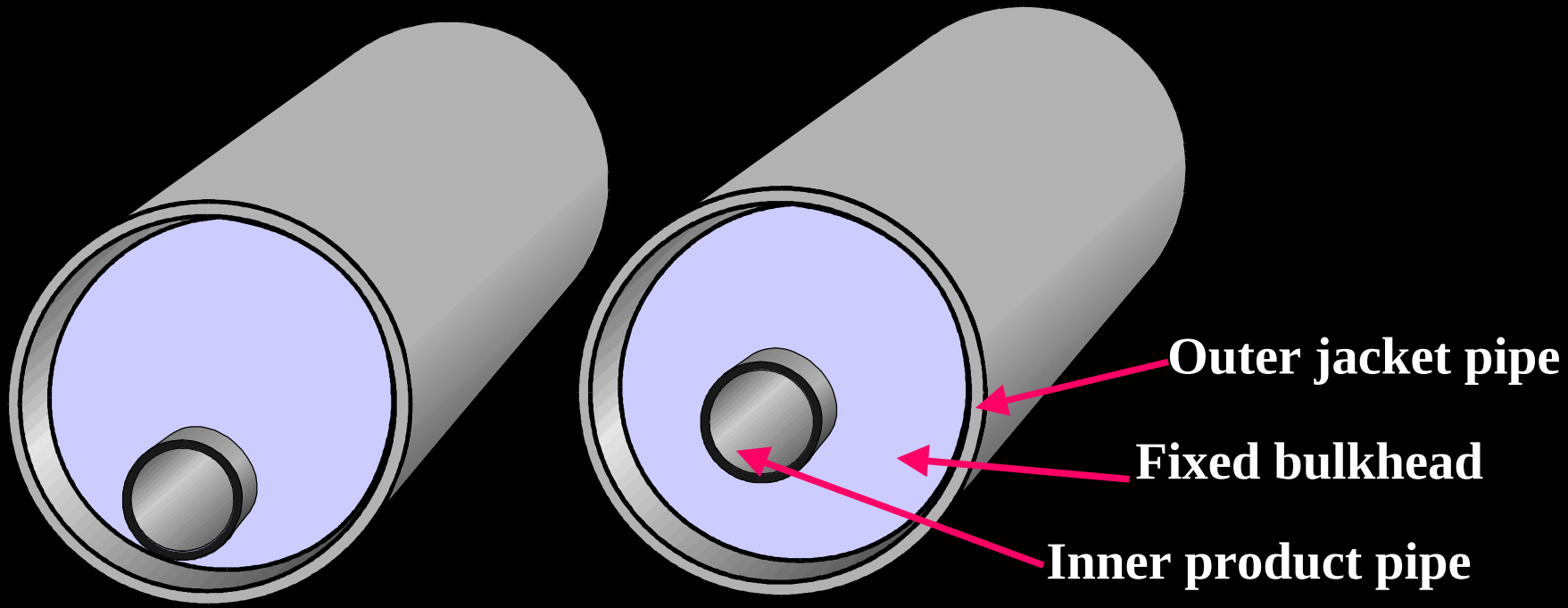
Typical Applications:

- increased insulation/protection
- controlled buoyancy for installation

Pipeline Configurations

Pipe-in-Pipe Pipelines

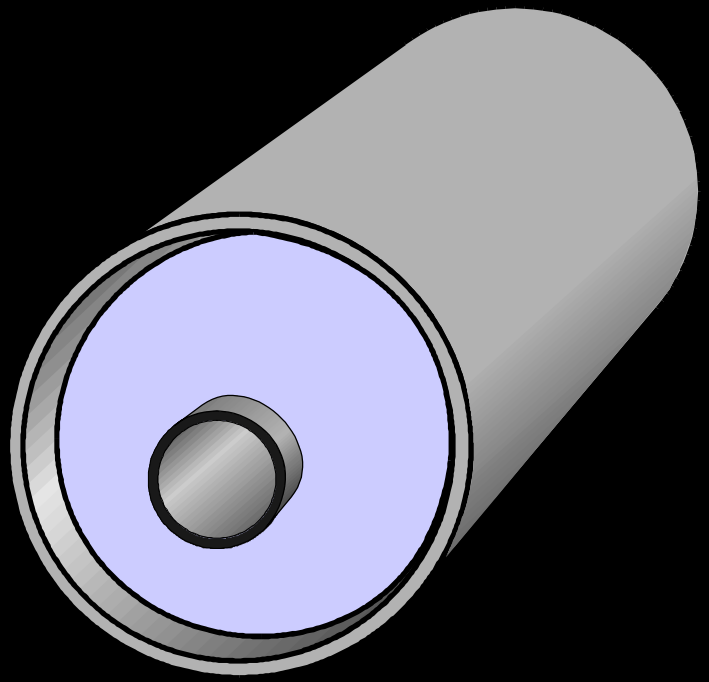
Single Pipe-in-Pipe with Fixed Bulkhead



Pipeline Configurations

Pipe-in-Pipe Pipelines

Single Pipe-in-Pipe with Fixed Bulkhead

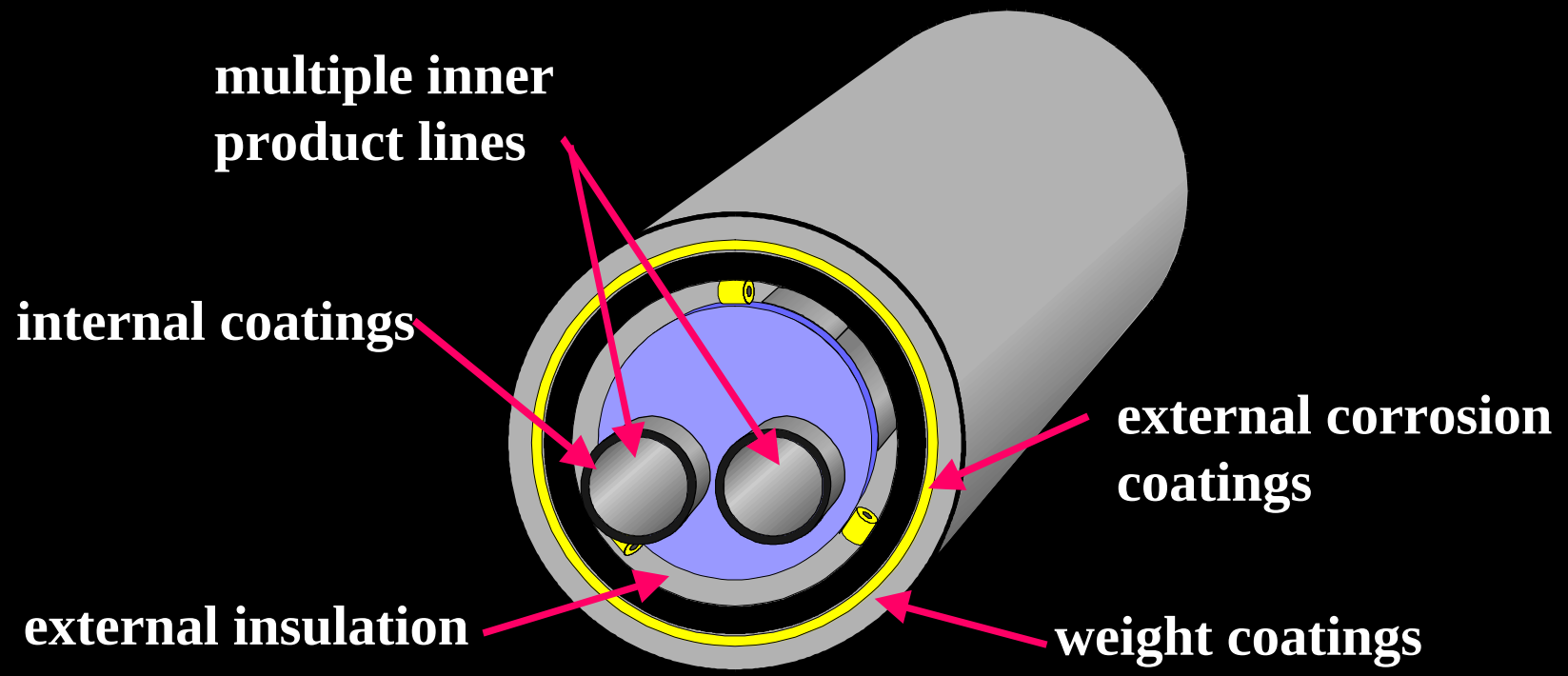


Typical Applications:

- insulation/protection
- two lines to optimize design
- offsets collapse stresses during installation

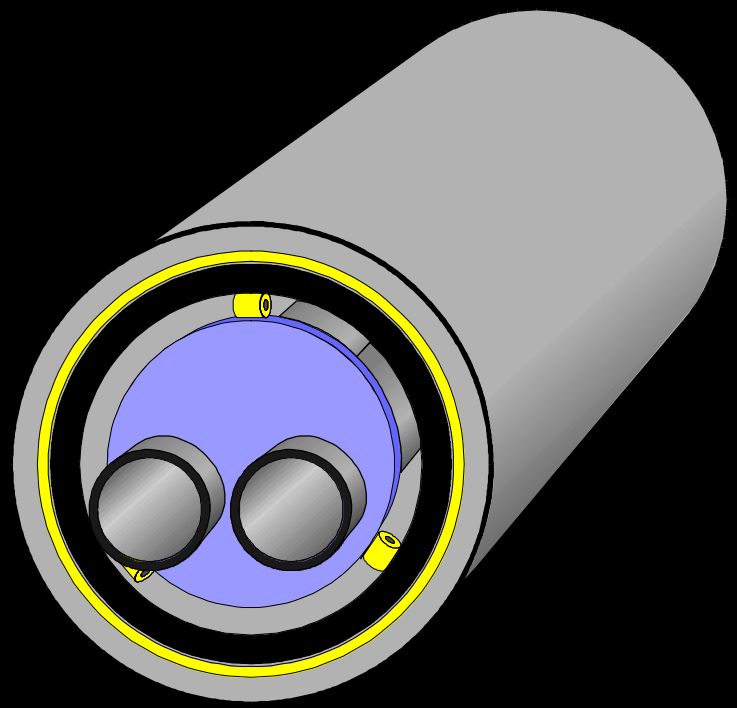
Pipeline Configurations

Cased Bundles



Pipeline Configurations

Cased Bundles

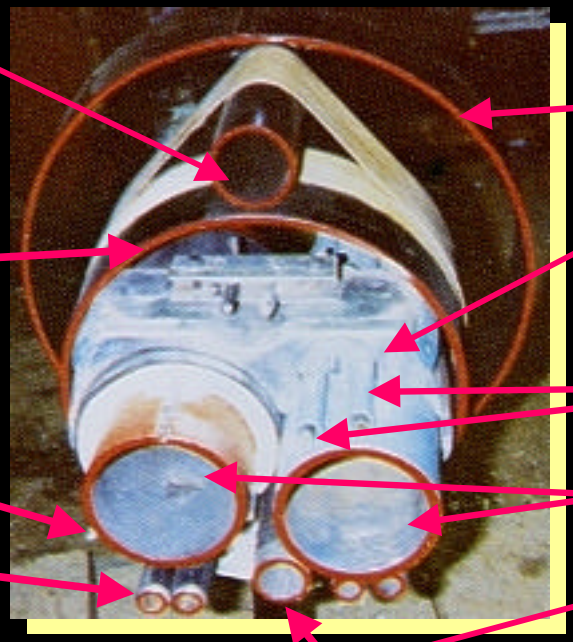


Typical Applications:

- unique and complex operating conditions
- need for utility lines, power, data
- additional insulation
- ease of installation

Pipeline Configurations

Cased Bundles - Drake F-76



Offshore Pipeline Installation Equipment and Methods

Installation Equipment

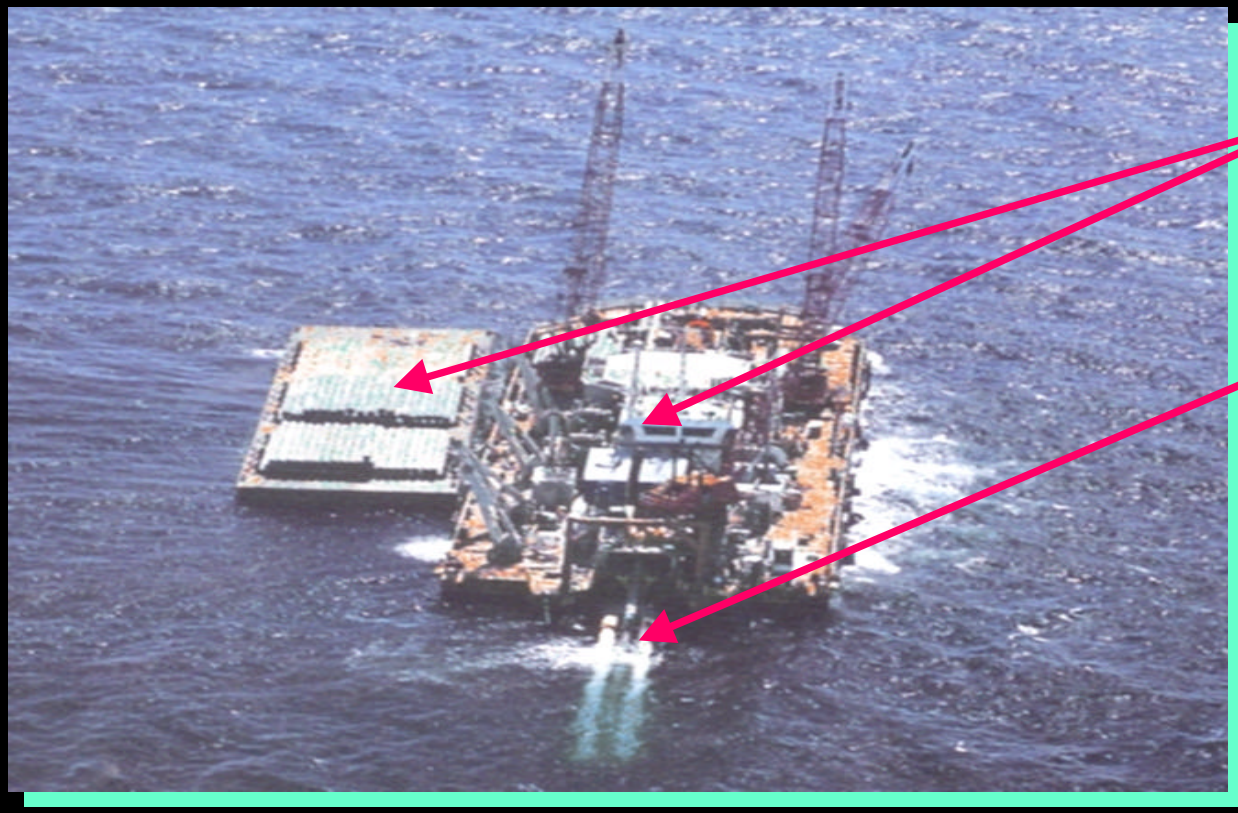
- lay barge
- reel barge/ship
- conventional pipeline spread

Installation Methods

- open water pipe lay
- tow or pull
- over-ice pipe lay

Pipeline Installation Equipment

Conventional Lay Barges



Pipeline Installation Equipment

Conventional Lay Barges

Typical Applications:

- open, calm water
- ice-free

Pipeline Installation Equipment

Reel Barges or Ships

Pipeline Installation Equipment

Reel Barges or Ships

Typical Applications:

- open, ice-free water
- deep water

Pipeline Installation Equipment

Conventional Pipeline Spread

Pipeline Installation Equipment

Conventional Pipeline Spread

Typical Applications:

- shore approach
- over-ice
- shallow water

Pipeline Installation Method

Open Water Lay

Typical Applications:

- open, calm water
- ice-free

Pipeline Installation Methods

Towed Bundles

Pipeline Installation Methods

Towed Bundles

Pipeline Installation Methods

Towed Bundles

Typical Applications:

- deep water
- pipe-in-pipe
- reduce installation forces on lay barge or reel barge
- narrow construction window

Pipeline Installation Methods

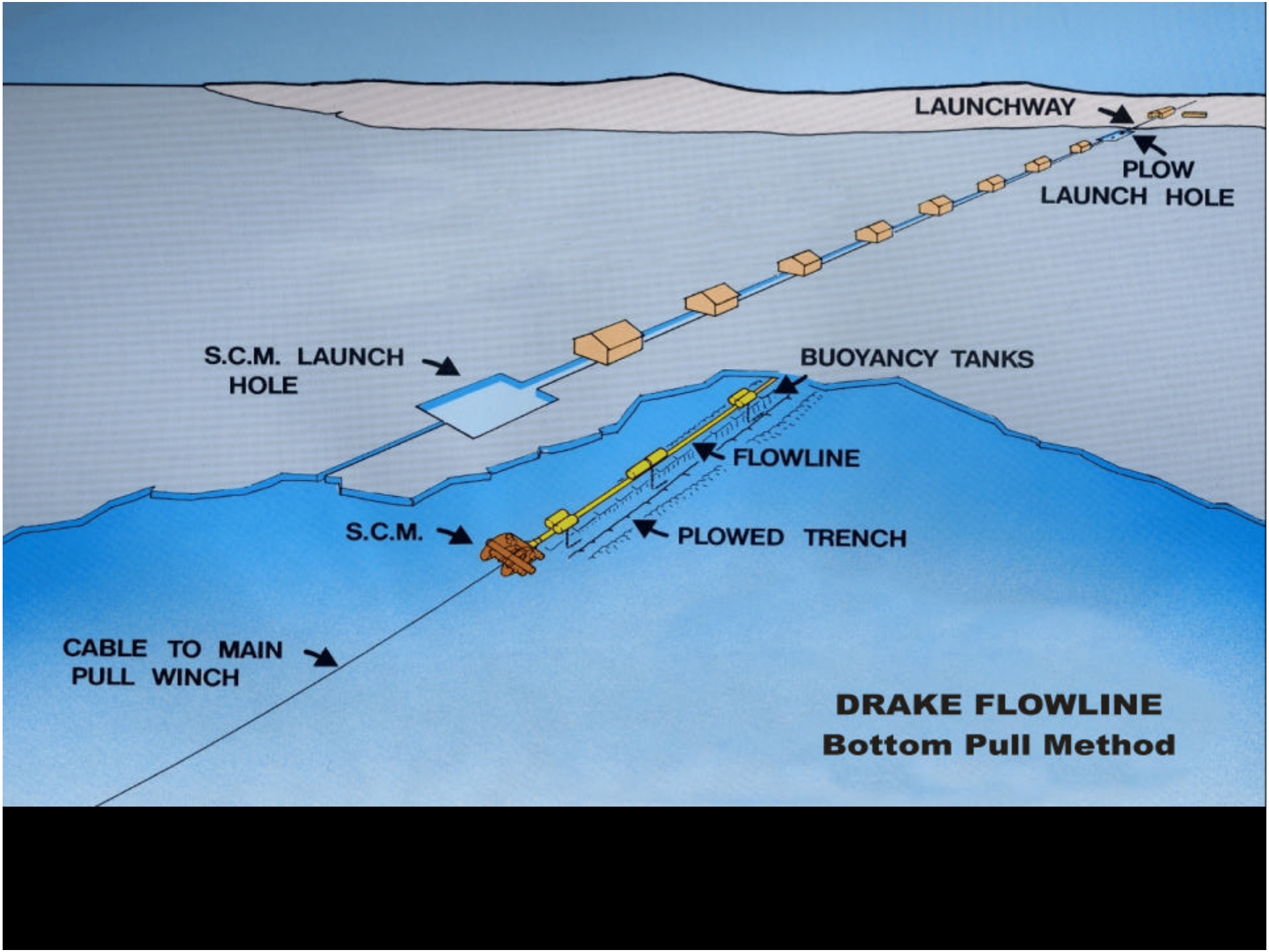
Over-ice Installation

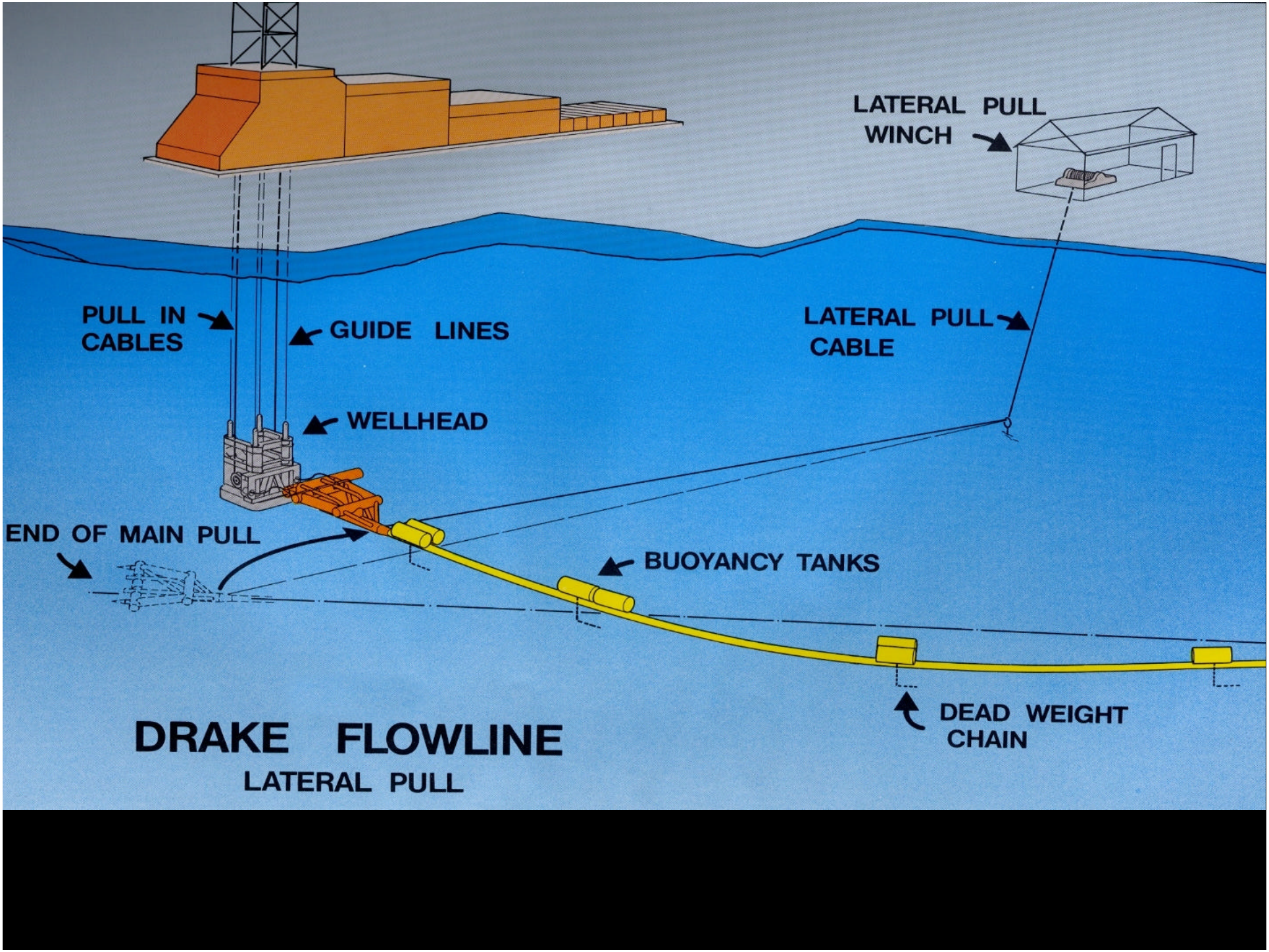
Pipeline Installation Methods

Over-ice Installation

Typical Applications:

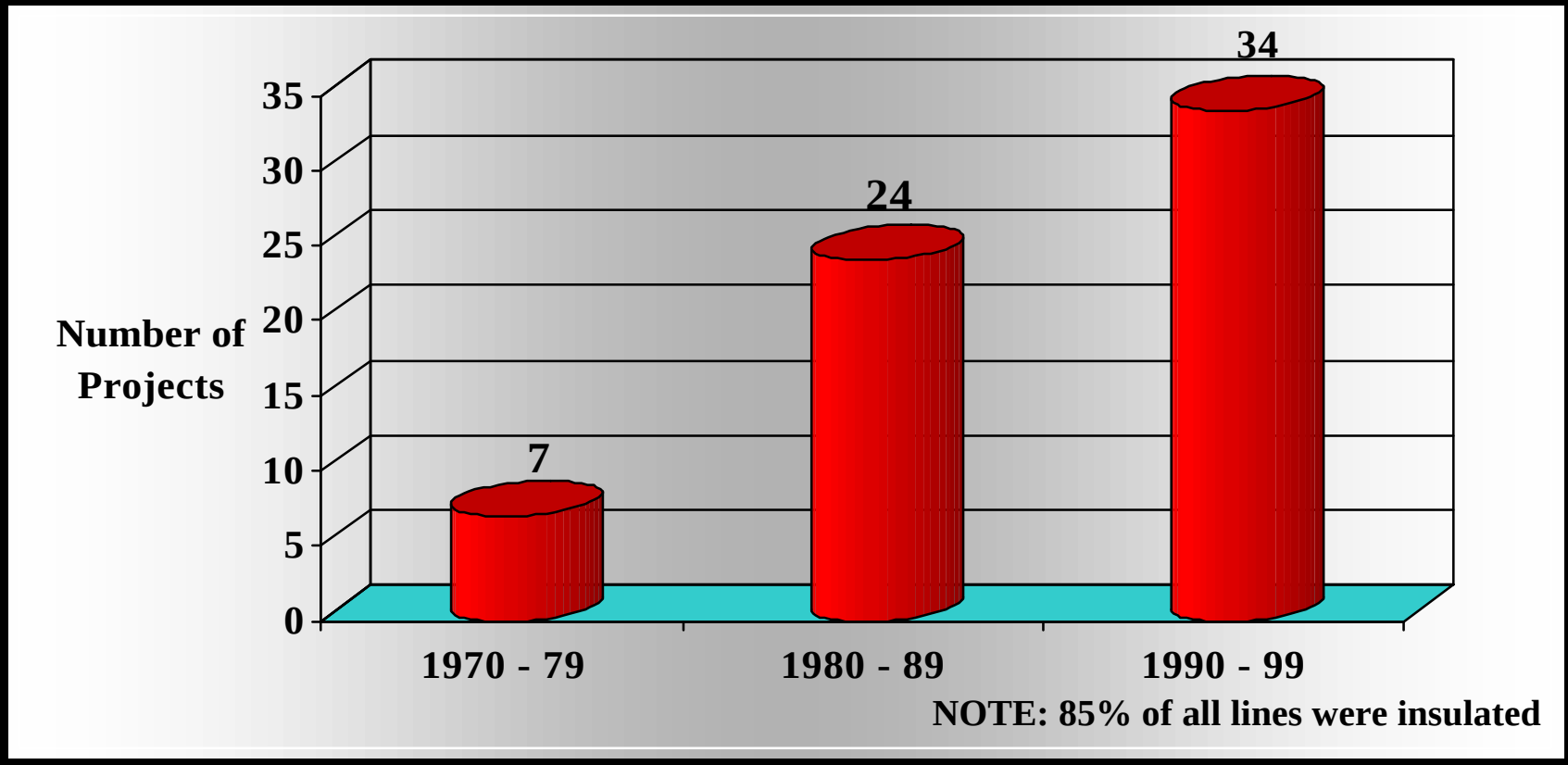
- arctic locations
- shallow water
- shoreline transitions


LAUNCHWAY
PLOW
LAUNCH HOLE
S.C.M. LAUNCH
HOLE
BUOYANCY TANKS
FLOWLINE
S.C.M.
PLOWED TRENCH
CABLE TO MAIN
PULL WINCH
DRAKE FLOWLINE
Bottom Pull Method


LATERAL PULL
WINCH
PULL IN
CABLES
GUIDE LINES
LATERAL PULL
CABLE
WELLHEAD
END OF MAIN PULL
BUOYANCY TANKS
DEAD WEIGHT
CHAIN
DRAKE FLOWLINE
LATERAL PULL

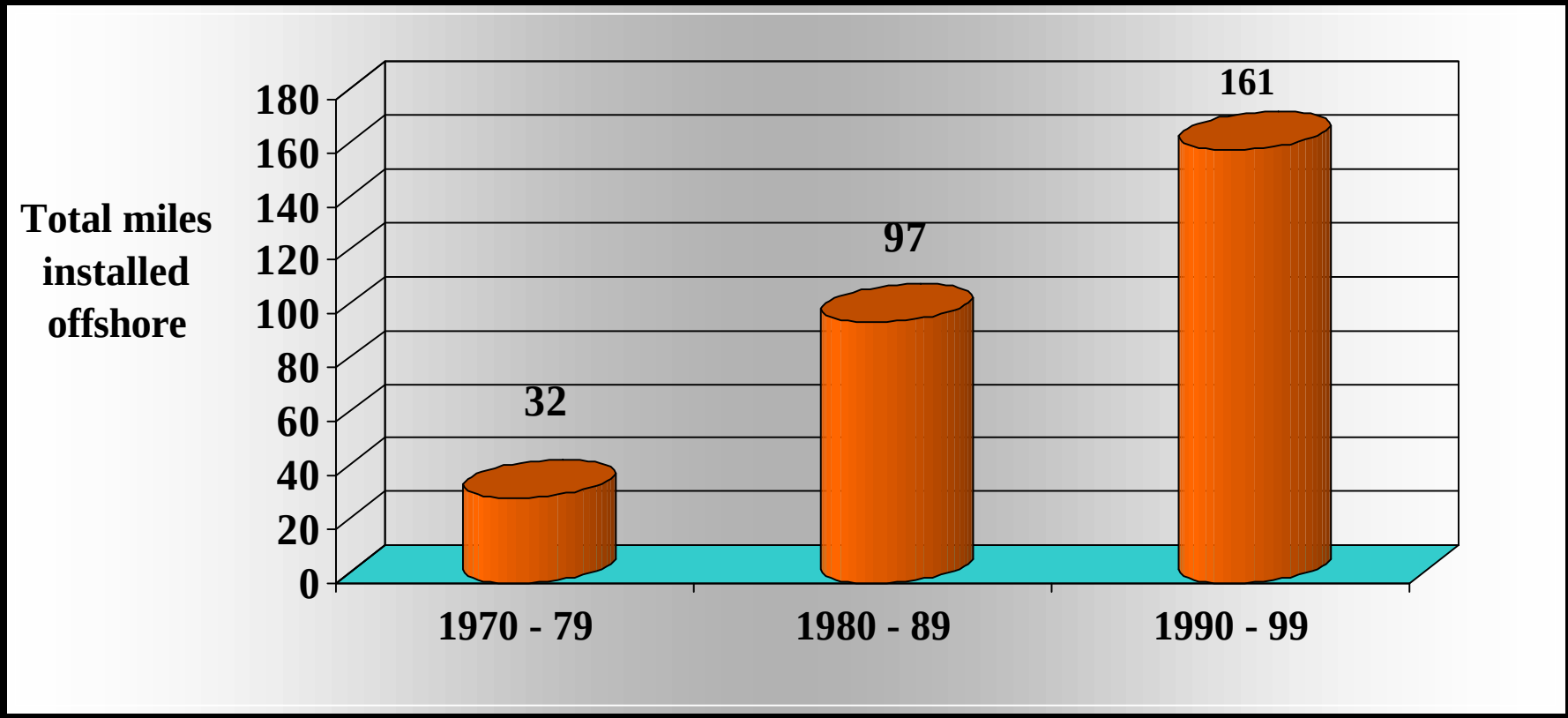
Pipe-in-Pipe and Bundle Statistics

Total Projects vs. Time



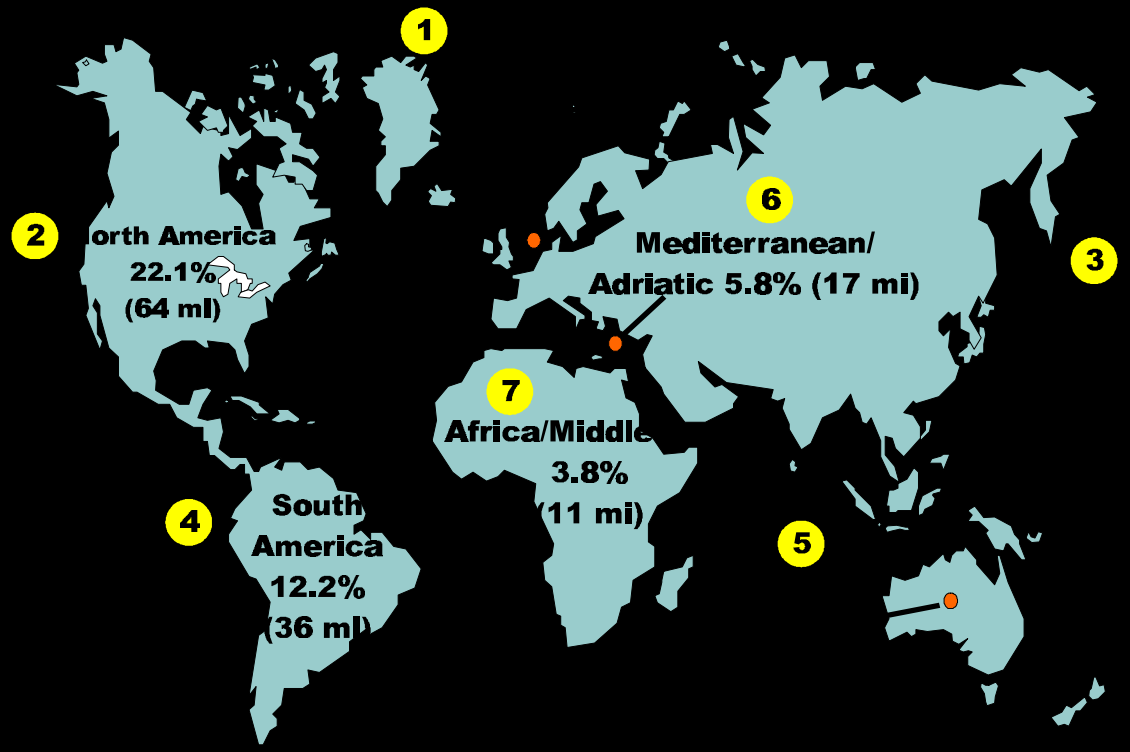
Pipe-in-Pipe and Bundle Statistics

Total Length vs. Time



Pipe-in-Pipe and Bundle Statistics

Geographical Distribution



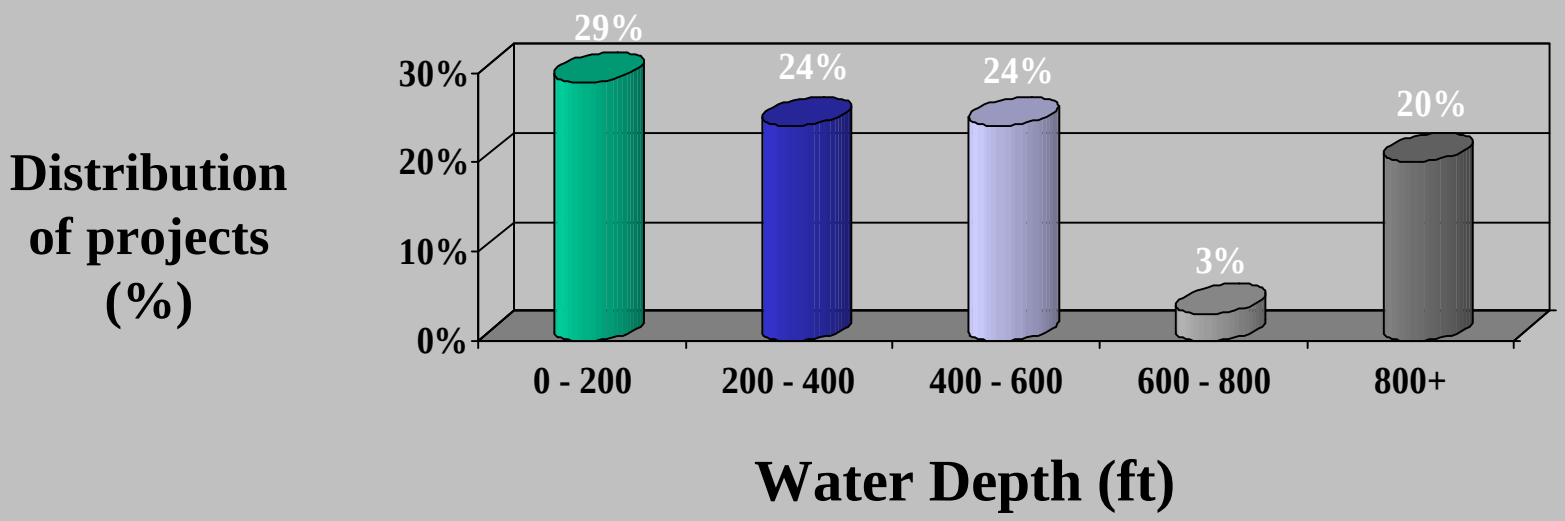
Pipe-in-Pipe and Pipe Statistics

Percentage of Total Pipeline Population

	North Sea	Gulf of Mexico
Total Offshore Pipe	**11,000 mi**	**23,000 mi**
Pipe-in-pipe/bundle	**1.0% (103 mi)**	**0.3% (64 mi)**

Pipe-in-Pipe and Pipe Statistics

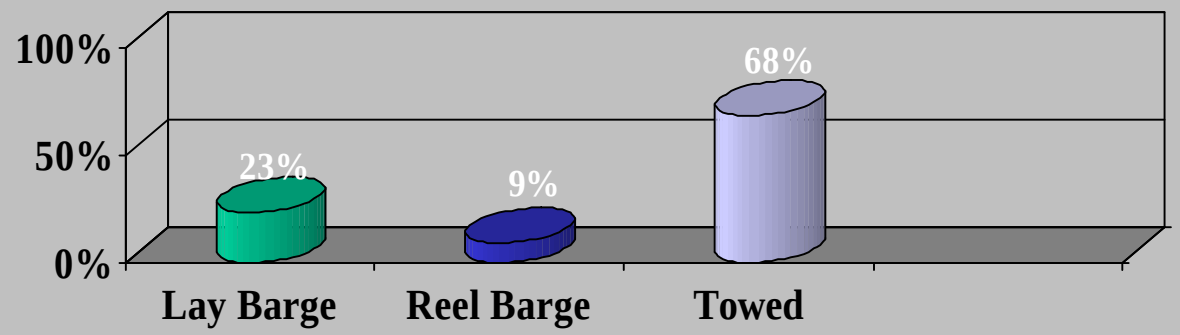
Water Depth for Projects



Pipe-in-Pipe and Bundle Statistics

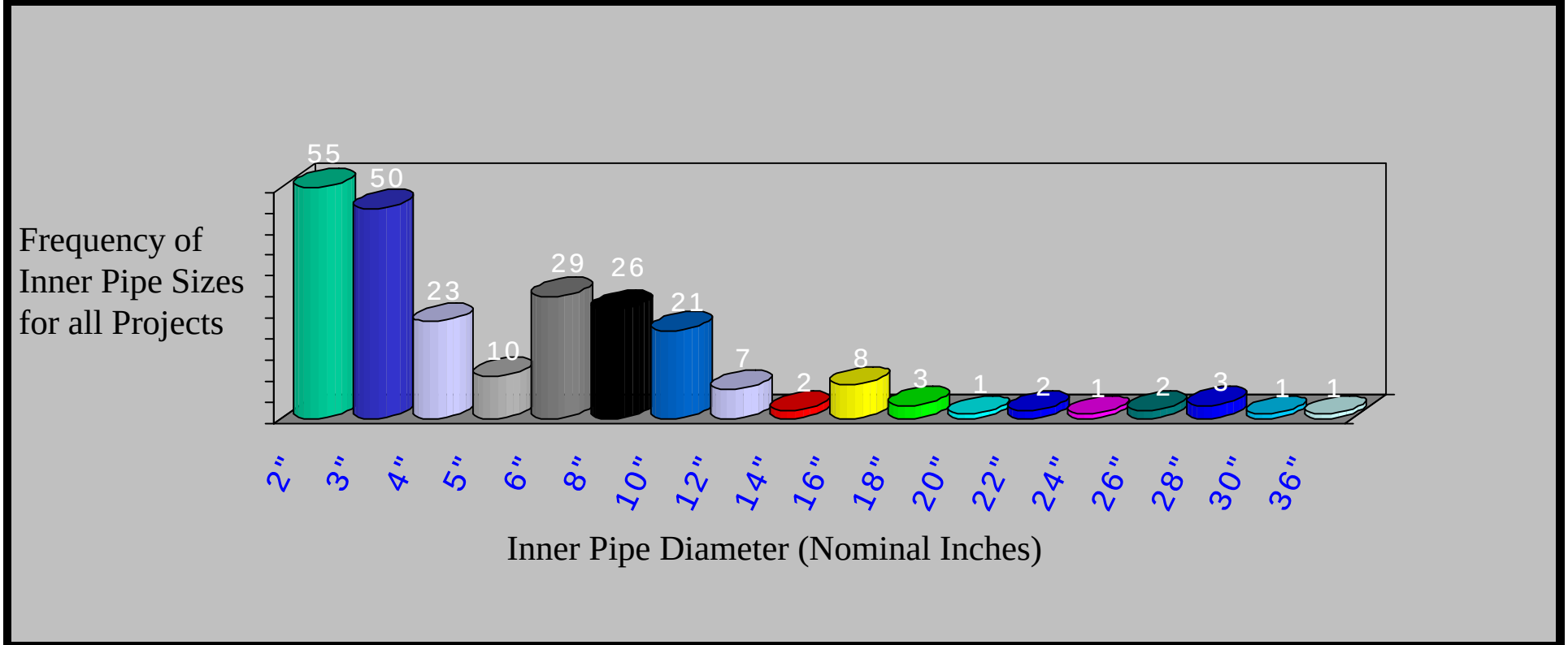
Installation Method

Distribution of installation methods (%)



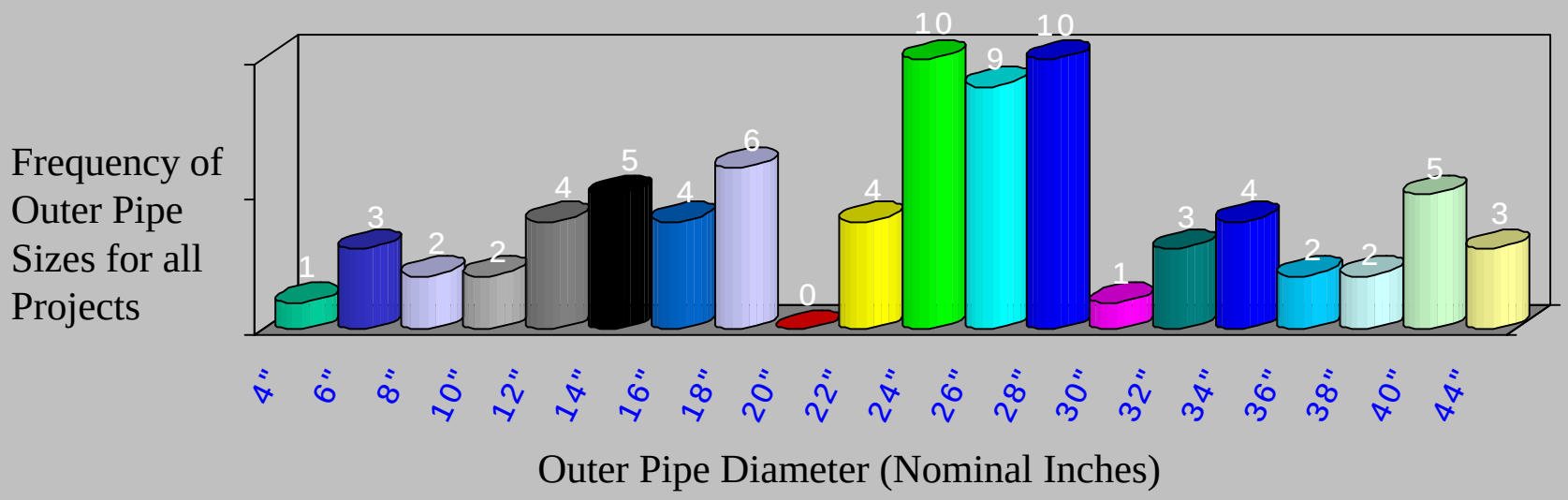
Pipe-in-Pipe and Bundle Statistics

Inner Pipe Diameter

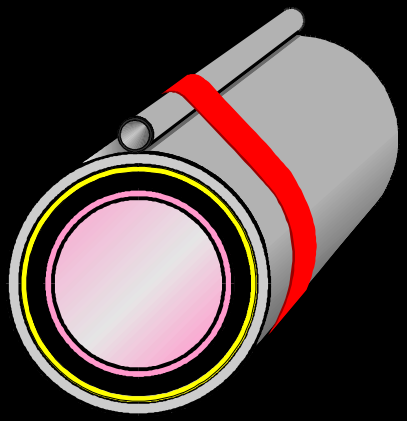


Pipe-in-Pipe and Bundle Statistics

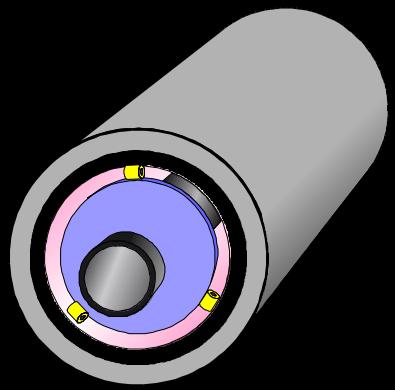
Outer Pipe Distribution



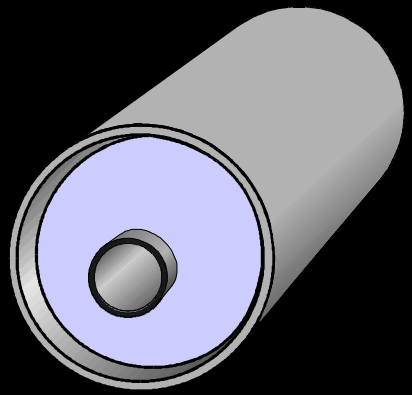
Summary:
Various Configurations



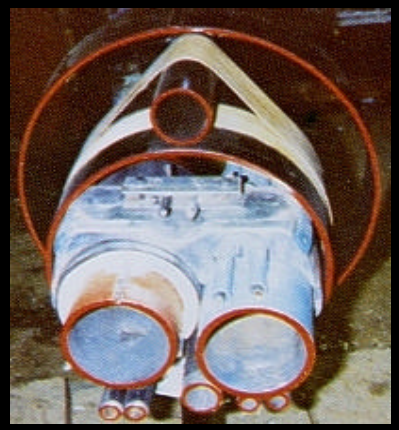
single wall
and external
bundle



pipe-in-pipe
with spacer



pipe-in-pipe
with bulkhead

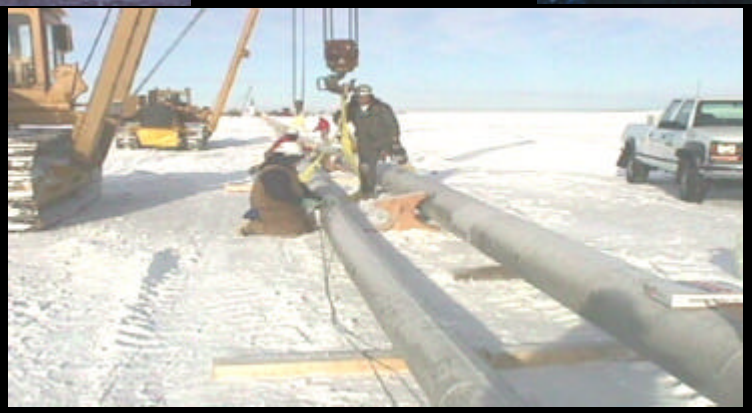


Drake F-76
bundle

Summary:
Various Installation Equipment

lay barge

reel ship



conventional pipeline spread

Summary:
Various Installation Methods

over-ice

open water pipe lay

tow or pull

Summary: Statistics

- >99% of all offshore lines are single wall
- increasing number of projects using pipe-in-pipe/bundles, most insulated
- high percentage used in deeper water
- towed installation method common
- wide range of sizes

An Overview of Pipeline Configuration Alternatives